Into the wild: Advancing lab-in-the-field research with biosensor-based approaches

Extended abstract

A growing interest in context-sensitive research has prompted scholars to reconsider how and where data should be collected. Traditionally, experimental research has been conducted inside laboratories, where experimental control ensures internal validity but limits ecological validity. This limitation has been widely acknowledged in the literature, with numerous studies underscoring how controlled settings may constrain the richness of human experience [1]. This issue is particularly salient in tourism research, a field concerned with multisensory and emotionally charged experiences [2]. Here, neurophysiological measures are increasingly employed, to investigate the visitor experience. Measures derived from cardiac, dermal, cortical or ocular responses are typically used to capture the embodied dimensions of experience, such as arousal, engagement, or affective responses, that remain often inaccessible through self-report methods [3]. For example, Di Dalmazi et al. employed galvanic skin response analysis to assess consumers' physiological arousal while experiencing tourism-related stimuli [4]. Similarly, Lui et al. investigated visitors' attention in VR environments using eye-tracking technology [5], while Bastiaansen et al. applied electroencephalography to examine users' emotional responses to tourism advertising stimuli [6].

To approach these issues, recent methodological developments in the social sciences suggest a way forward through what Gneezy and Imas term "lab-in-the-field" studies [7]. A lab-in-the-field experiment combines elements of both laboratory and field approaches, offering researchers a tool that retains the control and standardization of laboratory paradigms while gaining the ecological validity of real-world settings. Conceptually, lab-in-the-field research is conducted in naturalistic environments with theoretically relevant populations, but it employs validated and replicable experimental protocols derived from laboratory work. This hybrid model allows researchers to target the populations and contexts most pertinent to the phenomena under investigation while maintaining a level of experimental rigor. From a theoretical perspective, lab-in-the-field studies address a concern in experimental research: the trade-off between internal and external validity. By situating standardized experimental tasks in real-world contexts, researchers can study how cognitive and affective processes operate in situ without abandoning the ability to control for key variables [7].

The growing availability of wearable biosensors has made lab-in-the-field research increasingly attainable in practice. These portable devices, ranging from electrodermal activity and heart rate sensors to mobile electroencephalography, allow researchers to collect continuous physiological data in naturalistic settings with minimal intrusion. Importantly, these devices have been increasingly employed to measure correlates of affective responses, offering insights into arousal and engagement during tourism experiences [8]. Such technologies potentially extend laboratory precision into real-world environments, capturing the tourist experiences as they unfold in situ. Yet, the potential

to extend lab-in-the-field research through biosensors also introduces methodological and interpretive challenges, including issues of data quality in uncontrolled environments and the contextual interpretation of physiological responses.

Building on these premises, this paper aims to examine the opportunities and challenges of expanding lab-in-the-field research through biosensor-based approaches. Such an opportunity is investigated in the tourism field, a particularly desirable context due to its experiential nature, the emotional intensity of tourists' responses, and the ecological validity it offers for studying real-world behaviors. Specifically, it reports on an experiment comprising two complementary phases: a laboratory-based study involving 58 participants exposed to a natural landscape related to an Italian touristic natural destination through a virtual reality interface, and a corresponding field experiment replicating the same exposure in the actual natural setting with another 29 participants. Both experimental phases employ identical neurophysiological measures (i.e., cortical, cardiac, respiratory, and dermal responses) alongside self-reported affective responses, allowing for direct comparison between laboratory-based and lab-in-the-field experiences (see Fig. 1 and Fig. 2 for the research settings). Physiological data were collected using wearable sensors and mobile electroencephalography systems, following standardized protocols including pre-exposure calibration.

Through this comparative design, the study discusses the epistemological value, opportunities and the methodological challenges associated with biosensor-based lab-in-the-field research. First, it addresses the need to balance experimental control and ecological validity by examining how environmental complexity influences both data reliability and signal quality. In outdoor settings, factors such as weather conditions and ambient noise can introduce physiological signal noise or data loss, highlighting the trade-off between ecological authenticity and measurement precision. Second, it considers the issue of interpretive validity, focusing on how physiological indicators of emotion and affective states can be contextualized within real-world settings. Overall, the study contributes to the conceptual advancement of lab-in-the-field methodologies by demonstrating how biosensors can operationalize the integration of experimental rigor and ecological validity [7]. It extends current debates by emphasizing the epistemological value of embodied physiological data in tourism contexts and by providing practical guidance for future research. These include the development of biosensor protocols for outdoor settings and the integration of physiological signals with environmental data.

Fig. 1. Laboratory-based research setting

Fig. 2. Lab-in-the-field research setting

References

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